4
Natural Resource Management

Natural resource studies contribute to a better understanding of park resources, and help managers make better decisions.

The National Park Service will preserve the natural resources, processes, systems, and values of units of the national park system in an unimpaired condition, to perpetuate their inherent integrity and to provide present and future generations with the opportunity to enjoy them.

The National Park Service will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems, and values of the parks. The Service recognizes that natural processes and species are evolving, and will allow this evolution to continue, minimally influenced by human actions. The natural resources, processes, systems, and values that the Service preserves are described generally in the 1916 NPS Organic Act and in the enabling legislation or Presidential proclamation establishing each park. They are described in greater detail in management plans specific to each park. Natural resources, processes, systems, and values found in parks include:

- Physical resources such as water, air, soils, topographic features, geologic features, paleontological resources, natural soundscapes, and clear skies;
- Physical processes such as weather, erosion, cave formation, and wildland fire;
- Biological resources such as native plants, animals, and communities;
- Biological processes such as photosynthesis, succession, and evolution;
- Ecosystems; and
- Highly valued associated characteristics such as scenic views.

In this chapter, natural resources, processes, systems, and values are all included in the term "natural resources." The term "natural condition" is used here to describe the condition of resources that would occur in the absence of human dominance over the landscape.

The Service manages the natural resources of parks to maintain them in an unimpaired condition for future generations in accordance with NPS-specific statutes, including the NPS Organic Act and the National Parks Omnibus Management Act of 1998; general environmental laws such as the Clean Air Act, the Clean Water Act, the Endangered Species Act of 1973, NEPA, and the Wilderness Act; Executive orders; and applicable regulations.

Activities that take place outside park boundaries and that are not managed by the Service sometimes have profound effects on the Service's ability to protect natural resources inside parks. The Service must act to protect natural resources from impacts caused by external activities by working cooperatively with federal, state, and local agencies; Native American authorities; user groups; adjacent landowners; and others to identify and achieve broad natural resource goals. By working cooperatively through both formal and informal lines of communication and consultation, the Service will better achieve park management objectives and the protection of park natural resources.

(See Park Management 1.4; External Threats and Opportunities 1.5; Partnerships 4.1.4)

4.1 General Management Concepts

As explained in chapter 1 of these Management Policies, preserving park resources and values unimpaired is the core, or primary, responsibility of NPS managers. The Service cannot conduct or allow activities in parks that would impact park resources and values to a level that would constitute impairment. To comply with this mandate, park managers must determine in writing whether proposed activities in parks would impair natural resources. Park managers must also take action to ensure that ongoing NPS activities do not cause the impairment of park natural resources. In cases of doubt as to the impacts of activities on park natural resources, the Service will decide in favor of protecting the natural resources.

Natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems. Just as all components of a natural system will be recognized as important, natural change will also be recognized as an integral part of the functioning of natural systems. By preserving these natural components and processes in their natural condition, the Service will prevent resource degradation, and therefore avoid any subsequent need for resource restoration. In managing parks to preserve naturally evolving ecosystems, and in accordance with requirements of the National Parks Omnibus Management Act of 1998, the Service will utilize the findings of science and the analyses of scientifically trained resource specialists in decision-making.

The Service will not intervene in natural biological or physical processes, except:

- When directed by Congress;
- In some emergencies in which human life and property are at stake;
- To restore natural ecosystem functioning that has been disrupted by past or ongoing human activities; or
- When a park plan has identified the intervention as necessary to protect other park resources or facilities.

Any such intervention will be kept to the minimum necessary to achieve the stated management objectives.

Natural systems in the national park system, and the human influences upon them, will be monitored to detect change. The Service will use the results of monitoring and research to understand the detected change and to develop appropriate management actions.

Biological or physical processes altered in the past by human activities may need to be actively managed to restore them to a natural condition or to maintain the closest approximation of the natural condition in situations in which a truly natural system is no longer attainable. Prescribed burning and the control of ungulates when predators have been extirpated are two examples. The extent and degree of management actions taken to protect or restore park ecosystems or their components will be based on clearly articulated, well-supported management objectives and the best scientific information available.

There may be situations in which an area may be closed to visitor use to protect the natural resources (for example, during an animal breeding season) or for reasons of public

safety (for example, during a wildland fire). Such closures may be accomplished under the superintendent's discretionary authority, and will comply with applicable regulations (36 CFR 1.5 and 1.7).

(See The Prohibition on Impairment of Park Resources and Values 1.4.4; General Management Planning 2.3.1; Facility Planning and Design 9.1.1)

4.1.1 Planning for Natural Resource Management

Each park will prepare and periodically update a long-range (with at least one to two decades in view) comprehensive strategy for natural resource management, as appropriate. This long-range strategy will describe the comprehensive program of activities needed to achieve the desired future conditions for the park's natural resources. It will integrate the best available science, and will prescribe activities such as inventories, research, monitoring, restoration, mitigation, protection, education, and management of resource uses. The strategy will also describe the natural-resource-related activities needed to achieve desired future conditions for cultural resources (such as historic landscapes) and visitor enjoyment.

Similarly, planning for park operations, development, and management activities that might affect natural resources will be guided by high-quality, scientifically acceptable information, data, and impact assessment. Where existing information is inadequate, the collection of new information and data may be required prior to decision-making. Long-term research or monitoring may also be necessary to correctly understand the effects of management actions on natural resources whose function and significance are not clearly understood.

(See Decision-making Requirements to Avoid Impairments 1.4.7; General Management Planning 2.3.1; Land Protection Plans 3.3; Cultural Landscapes 5.3.5.2; Chapter 8: Use of the Parks; NPS-conducted or NPS–sponsored Inventory, Monitoring, and Research Studies 4.2.1; Chapter 9: Park Facilities)

4.1.2 Natural Resource Information

Information about natural resources that is collected and developed will be maintained in perpetuity. All forms of information collected through inventorying, monitoring, research, assessment, traditional knowledge, and management actions will be managed to professional and NPS archival and library standards.

Most information about park natural resources will be made broadly available to park employees, the scientific community, and the public. Pursuant to provisions of the National Parks Omnibus Management Act, the Service will withhold information about the nature and specific location of sensitive park natural resources—specifically mineral, paleontological, endangered, threatened, rare, or commercially valuable resources—unless the Service determines, in writing, that disclosure of the information would further the purposes of the park, would not create an unreasonable risk of harm, theft, or destruction of resources, and would be consistent with other applicable laws.

Under the Freedom of Information Act (FOIA), the NPS may be able to withhold sensitive natural resource data and information used in ongoing law enforcement investigations or subject to national security clearance classification. The Service may be able to withhold data provided through interim project reporting, pending the completion of relevant projects and the receipt of final project reports, as specified in approved scientific research and collecting permits and associated research proposals if the release of information will cause foreseeable harm to the interests of the NPS. Information that is made available to the public (that is, not withheld under FOIA or other laws) will remain searchable and accessible under the professional and NPS archival and library standards.

(See Information Confidentiality 1.7.3; Confidentiality 5.2.3. Also see Director's Order #66: FOIA and Protected Resource Information; Museum Handbook 24-Part II)

4.1.3 Evaluating Impacts on Natural Resources

Planning, environmental evaluation, and public involvement regarding management actions that may affect the natural resources of the National Park System are essential for carrying out the Service's responsibilities to present and future generations. The Service will ensure that the environmental costs and benefits of proposed operations, development, and resource management are fully and openly evaluated before taking actions that may impact the natural resources of parks. This evaluation must include appropriate participation by the public; the application of scholarly, scientific, and technical information in the planning, evaluation, and decision-making processes; the use of NPS knowledge and expertise through interdisciplinary teams and processes; and the aggressive incorporation of mitigation measures, pollution prevention techniques, and other principles of sustainable park management.

Every environmental assessment and environmental impact statement produced by the Service will include an analysis of whether the impacts of a proposed activity constitute impairment of park natural resources and values. Every finding of no significant impact, record of decision, and National Historic Preservation Act Section 106 memorandum of agreement signed by the NPS will contain a discrete certification that the impacts of the proposed activity will not impair park natural resources and values.

(See Park Management 1.4; Implementation Planning 2.3.3; NPS-conducted or -sponsored Inventory, Monitoring, and Research Studies 4.2.1. Also see Director's Order #12: Conservation Planning and Environmental Impact Analysis)

4.1.4 Partnerships

The Service will pursue opportunities to improve natural resource management within parks and across administrative boundaries by cooperating with public agencies, appropriate Native American representatives, and private landowners. The Service recognizes that cooperation with other land managers can accomplish ecosystem stability and other resource management objectives when the best efforts of a single manager might fail. Therefore, the Service will develop agreements with federal, tribal, state, and local governments and organizations, and private landowners, when appropriate, to coordinate plant, animal, water, and other natural resource management activities in ways that maintain and protect, not compromise, park resources and values. Such cooperation may include park restoration activities, research on park natural resources, and the management of species harvested in parks. Such coopera-

tion also may involve coordinating management activities in two or more separate areas, integrating management practices to reduce conflicts, coordinating research, sharing data and expertise, exchanging native biological resources for species management or ecosystem restoration purposes, establishing native wildlife corridors, and providing essential habitats adjacent to, or across, park boundaries.

In addition, the Service will seek the cooperation of others in minimizing the impacts of influences originating outside parks by controlling noise and artificial lighting, maintaining water quality and quantity, eliminating toxic substances, preserving scenic views, improving air quality, preserving wetlands, protecting threatened or endangered species, eliminating exotic species, managing the use of pesticides, protecting shoreline processes, managing fires, managing boundary influences, and in using other means of preserving and protecting natural resources.

(See External Threats and Opportunities 1.5; Partnerships 1.9; Addressing Threats from External Sources 3.4; Agreements 5.2.2)

4.1.5 Restoration of Natural Systems

The Service will re-establish natural functions and processes in human-disturbed components of natural systems in parks unless otherwise directed by Congress. Landscapes disturbed by natural phenomena, such as landslides, earthquakes, floods, hurricanes, tornadoes, and fires, will be allowed to recover naturally unless manipulation is necessary to protect park developments or visitor safety. Impacts to natural systems resulting from human disturbances include the introduction of exotic species; the contamination of air, water, and soil; changes to hydrologic patterns and sediment transport; the acceleration of erosion and sedimentation; and the disruption of natural processes. The Service will seek to return human-disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated. The Service will use the best available technology, within available resources, to restore the biological and physical components of these systems, accelerating both their recovery and the recovery of landscape and biological-community structure and function. Efforts may include, for example:

- Removal of exotic species;
- Removal of contaminants and non-historic structures or facilities;
- Restoration of abandoned mineral lands, abandoned or unauthorized roads, areas over-grazed by domestic animals, or disrupted natural waterways and/or shoreline processes;
- Restoration of areas disturbed by NPS administrative, management, or development activities (such as hazard tree removal, construction, or sand and gravel extraction) or by public use;
- Restoration of natural soundscapes; and
- Restoration of native plants and animals.

When park development is damaged or destroyed and replacement is necessary, the development will be replaced or relocated so as to promote the restoration of natural resources and processes.

(See Decision-making Requirements to Avoid Impairments 1.4.7; Restoration of Native Plant and Animal Species 4.4.2.2; Management of Natural Landscapes 4.4.2.4; Siting Facilities to Avoid Natural Hazards 9.1.1.6. Also see Director's Order #18: Wildland fire Management)

4.1.6 Compensation for Injuries to Natural Resources

The Service will take all steps necessary to protect and restore natural resources and the environmental benefits they provide when actions of another party cause the destruction or loss of, or injury to, park resources or values.

Pursuant to the National Park System Resource Protection Act, the Service will:

- Determine the injury caused to natural resources, assess all appropriate damages, and monitor damages;
- Seek to recover all appropriate costs associated with responses to such actions, and the costs of assessing resource damages, including the direct costs of response, restoration, and monitoring activities; and
- Use all sums recovered in compensation for re source injuries to restore, replace, or acquire the equivalent of the resources that were the subject of the action.

(See Compensation for Damages 5.3.1.3. Also see Director's Order #30C: Damage Assessments)

4.2 Studies and Collections

The Service will encourage appropriately reviewed natural resource studies whenever such studies are consistent with applicable laws and policies. These studies support the NPS mission by providing the Service, the scientific community, and the public with an understanding of park resources, processes, values, and uses that will be cumulative and constantly refined. This approach will provide a scientific and scholarly basis for park planning, development, operations, management, education, and interpretive activities.

The term "studies," as used here, means short- or long-term scientific or scholarly investigations or educational activities that may involve natural resource surveys, inventories, monitoring, and research, including data and specimen collection. Studies include projects conducted by researchers and scholars in universities, foundations and other institutions, tribal colleges and organizations, other federal and state agencies, and Service staff. The data and information acquired through studies conducted in parks will be made publicly available, consistent with section 4.1.2.

The Service will promote cooperative relationships with educational and scientific institutions and qualified individuals offering expertise that can assist the Service in obtaining information, and when the opportunity for research and study in the parks offers the cooperators a significant benefit to their programs. NPS facilities and assistance may be made available to qualified cooperators who are conducting NPS-authorized studies.

Studies in parks will be preceded by (1) an approved scope of work, proposal, or other detailed written description of the work to be performed; and (2) a written statement of environmental and cultural resource compliance appropriate to the proposed methodology and study site. All studies in parks will employ non-destructive methods to the maximum extent feasible with respect to resource protection, research methodology, and the scientific and management value of the information

and collections to be obtained. Although studies involving physical impacts to park resources or the removal of objects or specimens may be permitted, studies and collecting activities that will lead to the impairment of park resources and values are prohibited.

Scientific natural resource collecting activities are governed by 36 CFR 2.5. A very limited number of other types of natural resource collecting are governed by 36 CFR 2.1. In most cases, only small quantities may be collected. The repeated collection of materials to ensure a continuing source of supply for research or propagation is prohibited, unless the proposed activity clearly requires repeated collection, as might be the case with a monitoring or park restoration program.

(See Decision-making Requirements to Avoid Impairments 1.4.7; Managing Information 1.7; Research 5.1; Resource Access and Use 5.3.5.3.1; Collecting Natural Products 8.8; Consumptive Uses 8.9; Social Science Studies 8.11. Also see Director's Order #74: Studies and Collecting; Director's Order #78: Social Science)

4.2.1 NPS-conducted or -sponsored Inventory, Monitoring, and Research Studies

The Service will:

- Identify, acquire, and interpret needed inventory, monitoring, and research, including applicable traditional knowledge, to obtain information and data that will help park managers accomplish park management objectives provided for in law and planning documents.
- Define, assemble, and synthesize comprehensive baseline inventory data describing the natural resources under its stewardship, and identify the processes that influence those resources.
- Use qualitative and quantitative techniques to monitor key aspects of resources and processes at regular intervals.
- Analyze the resulting information to detect or predict changes, including interrelationships with visitor carrying capacities, that may require management intervention, and to provide reference points for comparison with other environments and time frames.
- Use the resulting information to maintain—and, where necessary, restore—the integrity of natural systems.

The Service may support studies to (among other things):

- Ensure a systematic, current, and fully adequate park information base;
- Provide a sound basis for policy, guidelines, and management actions;
- Develop effective strategies, methods, and technologies to restore disturbed resources, and to predict, avoid, or minimize adverse impacts on natural and cultural resources, and on visitors and related activities;
- Ensure that plans and actions reflect contemporary knowledge about the natural and cultural context of special natural areas, cultural landscapes, and natural resources having traditional cultural meaning and value to associated human groups;
- Determine the causes and potential resolution of natural resource management problems;
- Understand the ceremonial and traditional resource management practices of Native American tribes, subsistence uses by rural Alaska residents, and traditional uses by groups with demonstrated ties to particular natural resources of parks;
- Further understand park ecosystems and related human social systems, including visitors and gateway communities, and document their components, condition, and significance; and
- Ensure that the interpretation of the natural re sources and issues of parks reflects current standards of scholarship relating to the history, science, and condition of the resources.

Superintendents may authorize National Park Service staff to carry out routine inventory, monitoring, study, and related duties without requiring an NPS scientific research and collecting permit. With or without an NPS permit, Service staff will comply appropriately with professional standards and with general and park- specific research and collecting permit conditions. All research and data and specimen collection conducted by NPS employees will be appropriately documented and carried out in accordance with all laws, regulations, policies, and professional standards pertaining to survey, inventory, monitoring, and research. Service staff will be expected to make their findings available to the public, such as by publication in professional journals or presentation in interpretive programs.

Park inventory, monitoring, and research needs and specific research objectives will be identified in the appropriate management plans for each park, or in park, regional, or Service-wide program plans.

(See Decision-making Requirements to Avoid Impairments 1.4.7; Natural Resource Information 4.1.2; Restoration of Natural Systems 4.1.5; Weather and Climate 4.7.2; Miscellaneous Management Facilities 9.4.5)

4.2.2 Independent Studies

Non-NPS studies conducted in parks are not required to address specifically identified NPS management issues or information needs. However, these studies, including data and specimen collection, require an NPS scientific research and collecting permit. The studies must conform to National Park Service policies and guidelines regarding the collection and publication of data, the conduct of studies, wilderness restrictions, and park-specific requirements identified in the terms and conditions of the permit. Projects will be administered and conducted only by fully qualified personnel, and will conform to current standards of scholarship. Park Service scientific research and collecting permits may include requirements that permittees provide for parks, within agreed-upon time frames, copies of appropriate field notes, cataloging and other data, information about the data, progress reports, interim and final reports, and publications derived from the permitted activities.

(See Independent Research 5.1.2)

4.2.3 Natural Resource Collections

Natural resource collections include non-living and living specimens. Guidance for collecting and managing specimens and associated field records can be found in the Code of Federal Regulations (36 CFR 2.5) and NPS guidance docu-

ments, including the museum handbook. Non-living specimens and their associated field records are managed as museum collections. Living collections will be managed in accordance with the provisions of a park's management plan, the Animal Welfare Act, and other appropriate requirements.

Field data, objects, specimens, and features obtained for preservation during inventory, monitoring, research, and study projects, together with associated records and reports, will be managed over the long term within the museum collection. Specimens that are not authorized for consumptive analysis will be labeled and cataloged into an appropriate cataloging system in accordance with applicable regulations (36 CFR 2.5).

(See Paleontological Resources and Their Contexts 4.8.2.1; Collecting Natural Products 8.8; Consumptive Uses 8.9; Natural and Cultural Studies, Research, and Collection Activities 8.10; Social Science Studies 8.11. Also see Director's Order #24: Museum Management)

4.2.4 Collection Associated with the Development of Commercial Products

Extractive use of park resources for commercial purposes is prohibited except when specifically authorized by law or in the exercise of valid existing rights.

The collection of non-living or living material, or parts thereof, to support research that may lead to the development of commercial products is permitted only in limited circumstances, and is managed under appropriate federal authority. Permits for such collecting may be issued only after the applicant has signed a cooperative research and development agreement (CRADA) that includes equitable benefit sharing for the park research and resource management effort. CRADAs are subject to review by the Director and the Office of the Solicitor. Permits for collections associated with the development of commercial products are subject to NEPA compliance.

(Also see Director's Order #74: Studies and Collecting)

4.3 Special Designations

The Service recognizes that special designation labels apply to parts or all of some parks to highlight the additional management considerations that those designated areas warrant. These labels include Research Natural Area, Experimental Research Area, Wilderness Area, National Wild and Scenic River, National Natural Landmark, Biosphere Reserve, and World Heritage Site. These designations do not reduce the Service's authority for managing the parks, although in some cases they may create additional management requirements.

4.3.1 Research Natural Areas

Research Natural Areas contain prime examples of natural resources and processes, including significant genetic resources, that have value for long-term observational studies or as control areas for manipulative research taking place outside the parks. Superintendents recommend areas of parks to their regional director, who is authorized to designate them as Research Natural Areas. Superintendents cooperate with other federal land managers in identifying park sites for designation, and in planning research and educational activities for this interagency program.

Activities in Research Natural Areas generally will be restricted to non-manipulative research, education, and other activities that will not detract from an area's research values.

4.3.2 Experimental Research Areas

Experimental Research Areas are specific tracts that are set aside and managed for approved manipulative research. Manipulative research is defined as research in which conscious alteration of existing conditions is part of the experiment. The limited situations that may warrant establishment of Experimental Research Areas are identified in Natural Resources Reference Manual 77. Superintendents recommend areas of the park to their regional director, who is authorized to designate them as Experimental Research Areas.

4.3.3 Wilderness Areas

See chapter 6.

4.3.4 National Wild and Scenic Rivers System

Parks containing one or more river segments listed in the national rivers inventory maintained by the NPS, or that have characteristics that might make them eligible for the National Wild and Scenic Rivers System, will comply with section 5(d)(1) of the Wild and Scenic Rivers Act, which instructs each federal agency to assess whether those rivers are suitable for inclusion in the system. Such assessments, and any resulting management requirements, may be incorporated into a park's general management plan or other management plan. No management actions may be taken that could adversely affect the values that qualify a river for inclusion in the National Wild and Scenic Rivers System.

(See Wild and Scenic Rivers 2.3.10. Also see Wild and Scenic Rivers Act)

4.3.5 National Natural Landmarks

Park sites that are among the best examples of a type of biotic community or geological feature in its physiographic province may be nominated to the Secretary of the Interior for inclusion in the National Registry of Natural Landmarks. As the agency responsible for maintaining the registry, the Service has developed criteria for eligibility (36 CFR Part 62).

4.3.6 Biosphere Reserves

Biosphere Reserves are sites that are part of a world-wide network of natural reserves recognized for their roles in conserving genetic resources; facilitating long-term research and monitoring; and encouraging education, training, and the demonstration of sustainable resource use. A Biosphere Reserve is usually representative of a biogeographic province.

Parks may be nominated for recognition as Biosphere Reserves, or as constituents of Biosphere Reserves. Specific guidance for recognition is provided by the United States Man and Biosphere (MAB) program based on the general guidance of the United Nations Education, Scientific, and Cultural Organization (UNESCO). Working within the MAB program, the Service may assist in determining the suitability and feasibility of including parks in U.S. Biosphere Reserves, may participate in research and educational activities, and may furnish information on its Biosphere Reserves for inclusion in domestic and international information systems.

The designation of park lands as Biosphere Reserves, or as constituents of Biosphere Reserves, does not alter the purposes for which the parks were established, change the management requirements, or reduce NPS jurisdiction over parks. To the extent practicable, superintendents of parks that are recognized as Biosphere Reserves will incorporate biosphere reserve objectives into general management plans, implementation plans, action plans, and park interpretive programs. Superintendents will pursue opportunities to use the biosphere reserve designation as a framework for local, regional, and international cooperation.

4.3.7 World Heritage Sites

Parks containing natural features believed to possess "outstanding universal value to mankind" may be nominated to the World Heritage List. U.S. recommendations are approved by an interagency panel chaired by the Assistant Secretary for Fish and Wildlife and Parks, based on criteria promulgated by the World Heritage Committee. These criteria and the rules for U.S. participation in the Convention Concerning the World Cultural and Natural Heritage are published in 36 CFR Part 73. Once an area is designated a world heritage site, the Service will recognize the designation in public information and interpretive programs. Designation as a World Heritage Site will not alter the purposes for which the parks were established, change the management requirements, or reduce NPS jurisdiction over parks.

(See World Heritage List Designation 5.1.3.2.3)

4.4 Biological Resource Management

4.4.1 General Principles for Managing Biological Resources

The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals. The term "plants and animals" refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals. The Service will achieve this maintenance by:

- Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- Minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.

4.4.1.1 Plant and Animal Population Management Principles

The individual plants and animals found within parks are genetically parts of species populations that may extend across both park and non-park lands. As local populations within a group of populations naturally fluctuate in size, they become vulnerable to natural or human-caused extirpation during periods when their numbers are low. The periodic disappearance of local populations is common in some species, and the regional persistence of these species depends upon the natural recolonization of suitable habitat by individuals from the remaining local populations. Thus, providing for the persistence of a species in a park may require maintaining a number of local populations, often both within and outside the park.

In addition, some populations of vertebrate and invertebrate animals, such as bats, caribou, warblers, marine turtles, frogs, salmon, whales, and butterflies, migrate at regular intervals into and out of parks. For these migratory populations, the parks provide only one of the several major habitats they need, and survival of the species in parks also depends on the existence and quality of habitats outside the parks. The Service will adopt park resource preservation, development, and use management strategies that are intended to maintain the natural population fluctuations and processes that influence the dynamics of individual plant and animal populations, groups of plant and animal populations, and migratory animal populations in parks.

In addition to maintaining all native plant and animal species and their habitats inside parks, the Service will work with other land managers to encourage the conservation of the populations and habitats of these species outside parks whenever possible. To meet its commitments for maintaining native species in parks, the Service will cooperate with states, tribal governments, the U.S. Fish and Wildlife Service, and the National Marine fisheries Service, as appropriate, to:

- Participate in local and regional scientific and planning efforts, identify ranges of populations of native plants and animals, and develop cooperative strategies for maintaining or restoring these populations in the parks;
- Suggest mutually beneficial harvest regulations for lands and waters outside the parks for populations that extend across park boundaries, such as resident deer or fishes; for short-distance seasonal migrant populations, such as elk or fishes; or for long-distance migrant populations, such as salmon;
- Develop data, through monitoring, for use in plant and animal management programs (such as local land management decision-making for assessing resident plant and animal population trends, and in international management negotiations for such far-ranging seasonal migrants as geese, whales, and marine turtles);
- Present information about species life cycles, ranges, and population dynamics in park interpretive programs for use in increasing public awareness of management needs for all species, both resident and migrant, that occur in parks; and
- Prevent the introduction of exotic species into units of the National Park System, and remove populations of these species that have already become established in parks.

4.4.1.2 Genetic Resource Management Principles

The Service will strive to protect the full range of genetic types (genotypes) of native plant and animal populations in the parks by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity.

The restoration of native plants and animals will be accomplished using organisms taken from populations as closely related genetically and ecologically as possible to park populations, preferably from similar habitats in adjacent or local areas. Deviations from this general policy may be made where

the management goal is to increase the variability of the park gene pool to mitigate past, human-induced loss of genetic variability. Actions to transplant organisms for purposes of restoring genetic variability through gene flow between native breeding populations will be preceded by an assessment of the genetic compatibility of the populations.

The need to maintain appropriate levels of genetic diversity will guide decisions on what actions to take to manage isolated populations of species or to enhance the recovery of populations of rare, threatened, or endangered species. All resource management actions involving planting or relocating species, subspecies, or varieties will be guided by knowledge of local adaptations, ranges, and habitat requirements, and detailed knowledge of site ecological histories.

When native plants or animals are removed for any reason—such as hunting, fishing, pest management, or culling to reduce unnatural population conditions resulting from human activities—the Service will maintain the appropriate levels of natural genetic diversity.

(See Restoration of Native Plant and Animal Species 4.4.2.2; Restoration of Natural Systems 4.1.5)

4.4.1.3 Definition of Native and Exotic Species:

"Native species" are defined as all species that have occurred or now occur as a result of natural processes on lands designated as units of the national park system. Native species in a place are evolving in concert with each other. "Exotic species" are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as non-native, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place.

4.4.2 Management of Native Plants and Animals

Whenever possible, natural processes will be relied upon to maintain native plant and animal species, and to influence natural fluctuations in populations of these species. The Service may intervene to manage individuals or populations of native species only when such intervention will not cause unacceptable impacts to the populations of the species or to other components and processes of the ecosystems that support them, and when at least one of the following conditions exists:

- Management is necessary
  - because a population occurs in an unnaturally high or low concentration as a result of human influences (such as loss of seasonal habitat, the extirpation of predators, the creation of highly productive habitat through agriculture or urban landscapes) and it is not possible to mitigate the effects of the human influences;
  - to protect specific cultural resources of parks;
  - to accommodate intensive development in portions of parks appropriate for, and dedicated to, such development;
  - to protect rare, threatened, or endangered species;
  - to protect human health as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Service Program);
  - to protect property in cases in which it is not possible to change the pattern of human activities; or
  - to maintain human safety in cases in which it is not possible to change the pattern of human activities.
- Or, removal of individuals or parts thereof
  - is part of an NPS research project described in an approved management plan, or is part of research being conducted by others who have been issued a scientific research and collecting permit;
  - is done to provide plants or animals for restoring native populations in parks or cooperating areas without diminishing the viability of the park populations from which the individuals are taken; or
  - meets specific park management objectives.

The Service will assess the results of managing plant and animal populations by conducting follow-up monitoring or other studies to determine the impacts of the management methods on non-targeted, as well as targeted, components of the ecosystem.

4.4.2.1 NPS Actions That Remove Plants and Animals:

Whenever the Service removes plants or animals, manages plant or animal populations to reduce their sizes, or allows others to remove plants or animals for an authorized purpose, the Service will seek to ensure that such removals will not cause unacceptable impacts to native resources, natural processes, or other park resources. Whenever the Service identifies a possible need for reducing the size of a park plant or animal population, the Service will use scientifically valid resource information obtained through consultation with technical experts, literature review, inventory, monitoring, or research to evaluate the identified need for population management, and to document it in the appropriate park management plan.

In planning and implementing plant and animal population management actions, the Service will follow established planning procedures, including provisions for public review and comment. The Service will consult, as appropriate, with other federal land-managing agencies, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, state agencies, tribal governments, and others. Such consultation will address (1) the management of selected animal populations, (2) research involving the taking of animal species of management interest to these agencies, and (3) cooperative studies and plans dealing with the public hunting and fishing of animal populations that occur across park boundaries.

In addition, the Service will manage such removals to prevent them from interfering broadly with:

- Natural habitats, natural abundances, and natural distributions of native species and natural processes;
- Rare, threatened, and endangered plant or animal species or their critical habitats;
- Scientific study, interpretation, environmental education, appreciation of wildlife, or other public benefits;
- Opportunities to restore depressed populations of native species; or
- Breeding or spawning grounds of native species.

Where the need to reduce animal populations may be due to persistent human/animal conflicts, the Service will determine whether or not it can eliminate or mitigate the conflicts by modifying or curtailing the conflicting visitor use or other human activities. Where visitor use or other human activities

cannot be modified or curtailed, the Service may directly reduce the animal population by using several animal population management techniques, either separately or together. These techniques include relocation, public hunting on lands outside the park, habitat management, predator restoration, reproductive intervention, and destruction of animals by NPS personnel or their authorized agents. Where animal populations are reduced, destroyed animals may be left in natural areas of the park to decompose. Live animals or carcasses may be removed from parks according to the provisions of applicable laws, agreements, and regulations, including the granting of preference to Native Americans.

(See Pest Management 4.4.5. Also see Director's Order #18: Wildland fire Management; and #60B)

4.4.2.2 Restoration of Native Plant and Animal Species

The Service will strive to restore extirpated native plant and animal species to parks whenever all of the following criteria are met:

- Adequate habitat to support the species either exists or can reasonably be restored in the park, and if necessary also on adjacent public lands and waters, and, once a natural population level is achieved, the population can be self-perpetuating;
- The species does not, based on an effective management plan, pose a serious threat to the safety of people in parks, park resources, or persons or property outside park boundaries;
- The genetic type used in restoration most nearly approximates the extirpated genetic type; and
- The species disappeared, or was substantially diminished, as a direct or indirect result of human-induced change to the species population or to the ecosystem.

Programs to restore animal species may include confining animals in small field enclosures during restoration efforts, but only until the animals have become accustomed to the new area, or they have become sufficiently established to minimize threats from predators, poaching, disease, or other factors. Programs to restore animal species may also include confining animals in cages for captive breeding to increase the number of offspring for release to the wild or to manage the population's gene pool. Programs to restore plant species may include propagating plants in greenhouses, gardens, or other confined areas to develop propagation materials (propagules) for restoration efforts or to manage a population's gene pool.

(See Restoration of Natural Systems 4.1.5)

4.4.2.3 Management of Threatened or Endangered Plants and Animals

The Service will survey for, protect, and strive to recover all species native to national park system units that are listed under the Endangered Species Act. The Service will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species. To meet these obligations, the Service will:

- Cooperate with both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to ensure that National Park Service actions comply with both the written requirements and the spirit of the Endangered Species Act. It is particularly important that this cooperation includes the full range of activities associated with the Endangered Species Act, including consultation, conferencing, informal discussions, and securing of all necessary scientific and/or recovery permits.
- Undertake active management programs to inventory, monitor, restore, and maintain listed species' habitats, control detrimental non-native species, control detrimental visitor access, and re-establish extirpated populations as necessary to maintain the species and the habitats upon which they depend.
- Manage designated critical habitat, essential habitat, and recovery areas to maintain and enhance their value for the recovery of threatened and endangered species.
- Cooperate with other agencies to ensure that the delineation of critical habitat, essential habitat, and/or recovery areas on park-managed lands provides needed conservation benefits to the total recovery efforts being conducted by all the participating agencies.
- Participate in the recovery planning process, including the provision of members on recovery teams and recovery implementation teams where appropriate.
- Cooperate with other agencies, states, and private entities to promote candidate conservation agreements aimed at precluding the need to list species.
- Conduct actions and allocate funding to address endangered, threatened, proposed, and candidate species.

The National Park Service will inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible. In addition, the Service will inventory other native species that are of special management concern to parks (such as rare, declining, sensitive, or unique species and their habitats) and will manage them to maintain their natural distribution and abundance.

The Service will determine all management actions for the protection and perpetuation of federally, state, or locally listed species through the park management planning process, and will include consultation with lead federal and state agencies as appropriate.

4.4.2.4 Management of Natural Landscapes

Landscapes disturbed by natural phenomena, such as landslides, earthquakes, floods, hurricanes, tornadoes, and fires, will be allowed to recover naturally unless manipulation is necessary to mitigate for excessive disturbance caused by past human effects, or to protect park developments or the safety of people using those developments. Landscape and vegetation conditions altered by human activity may be manipulated where the park management plan provides for restoring the lands to a natural condition. Management activities to restore human-altered landscapes may include, but are not restricted to:

- Removing constructed features, restoring natural topographic gradients, and revegetating with native park species on acquired inholdings and on sites from which previous development is being removed;

- Restoring natural processes and conditions to areas disturbed by human activities such as fire suppression;
- Rehabilitating areas disturbed by visitor use or by the removal of hazard trees; and
- Maintaining open areas and meadows in situations in which they were formerly maintained by natural processes that now are altered by human activities.

Landscape revegetation efforts will use seeds, cuttings, or transplants representing species and gene pools native to the ecological portion of the park in which the restoration project is occurring. Where a natural area has become so degraded that restoration with gene pools native to the park has proven unsuccessful, improved varieties or closely related native species may be used.

Landscape restoration efforts will use geological materials and soils obtained in accordance with geological and soil resource management policies. Landscape restoration efforts may use, on a temporary basis, appropriate soil fertilizers or other soil amendments so long as that use does not unacceptably alter the physical, chemical, or biological characteristics of the soil and biological community, and does not degrade surface or ground waters.

(See Restoration of Natural Systems 4.1.5; Cultural Landscapes 5.3.5.2)

4.4.2.5 Maintenance of Altered Plant Communities

In altered plant communities managed for a specified purpose, plantings will consist of species that are native to the park or that are historically appropriate for the period or event commemorated. Communities altered to maintain habitat for threatened or endangered species may only use native plants, and the manipulation of existing plants will be carried out in a manner designed to enhance the recovery of the threatened or endangered species, or the recovery of the natural functioning of the plant and animal community of which the endangered species is a natural part. Use of exotic plants must conform to exotic species policy. Use of non-natural plantings in altered communities may be permitted under any of the following conditions:

- In localized, specific areas, screen plantings may be used to protect against the undesirable impacts of adjacent land uses, provided that the plantings do not result in the invasion of exotic species.
- Where necessary to preserve and protect the desired condition of specific cultural resources and landscapes, plants and plant communities generally will be managed to reflect the character of the landscape that prevailed during the historic period. Efforts may be made to extend the lives of specimen trees dating from the historic period being commemorated. An individual tree or shrub known to be of historic value that is diseased beyond recovery and has become hazardous will be removed and may be replaced. While specimen trees or shrubs that need to be perpetuated are still healthy, their own progeny will be propagated from seeds or through vegetative reproduction, such as cuttings.
- Where cultivated crop plants may be needed for livestock or agricultural uses that are allowed as part of the cultural landscape, authorized by federal law, or retained as a property right.
- Where needed for intensive development areas. Such plantings will use native or historic species and materials to the maximum extent possible. Certain native species may be fostered for esthetic, interpretive, or educational purposes.

  Exotic species may not be used to vegetate vista clearings in otherwise-natural vegetation.

Limited, recurring use of soil fertilizers or other soil amendments may be allowed only as needed to maintain the desired condition of the altered plant community, and only where such use does not unacceptably alter the physical, chemical, or biological characteristics of the soil and biological community, and does not degrade surface or ground waters.

(See Management of Exotic Species 4.4.4; Cultural Landscapes 5.3.5.2)

4.4.3 Harvest of Plants and Animals by the Public

Public harvesting of designated species of plants and animals, or their components, may be allowed in park units when:

- Hunting, trapping, subsistence use, or other harvesting is specifically authorized by statute or regulation and not subsequently prohibited by regulation;
- Harvest of certain plant parts or unoccupied seashells for personal consumption or use is specifically authorized by the superintendent in accordance with 36 CFR 2.1(c)(1);
- Recreational fishing is not specifically prohibited; or
- Commercial fishing is specifically authorized by statute or regulation.

Where harvesting is allowed and subject to NPS control, the Service will allow harvesting only when the monitoring requirement contained in section 4.4.2 and the criteria in section 4.4.2.1, above, have been met, and the Service has determined that the harvesting will not unacceptably impact park resources or natural processes, including the natural distributions, densities, age-class distributions, and behavior of:

- Harvested species;
- Native species that the harvested species use for any purpose; or
- Native species that use the harvested species for any purpose.

The Service will manage harvesting programs, and any associated habitat management programs intended to restore and maintain habitats supporting harvested plant or animal populations, to conform with applicable federal and state regulations and in consultation and cooperation, as appropriate, with individual states or tribal governments.

Habitat manipulation for harvested species may include the restoration of a disturbed area to its natural condition so it can become self-perpetuating, but will not include the artificial manipulation of habitat to increase the numbers of a harvested species above its natural range in population levels.

The Service may encourage the intensive harvesting of exotic species in certain situations when needed to meet park management objectives.

In some situations, the Park Service may stock native or exotic animals for recreational harvesting purposes, but only when such stocking will not impair park natural resources or processes, and:

- The stocking is of fish into constructed large reservoirs or other significantly altered large water bodies and the purpose is to provide for recreational fishing; or
- Such stocking is in a national recreation area or preserve that has historically been stocked (in these situations, stocking only of the same species may be continued); or
- Congressional intent for stocking is expressed in statute or a House or Senate report accompanying a statute.

The Service will not stock waters that are naturally barren of harvested aquatic species.

4.4.4 Management of Exotic Species

Exotic species will not be allowed to displace native species if displacement can be prevented.

4.4.4.1 Introduction or Maintenance of Exotic Species

In general, new exotic species will not be introduced into parks. In rare situations, an exotic species may be introduced or maintained to meet specific, identified management needs when all feasible and prudent measures to minimize the risk of harm have been taken, and it is:

- A closely related race, subspecies, or hybrid of an extirpated native species; or
- An improved variety of a native species in situations in which the natural variety cannot survive current, human-altered environmental conditions; or
- Used to control another, already-established exotic species; or
- Needed to meet the desired condition of a historic resource, but only where it is prevented from being invasive by such means as cultivating (for plants), or tethering, herding, or pasturing (for animals). In such cases, the exotic species used must be known to be historically significant, to have existed in the park during the park's period of historical significance, or to have been commonly used in the local area at that time; or
- An agricultural crop used to maintain the character of a cultural landscape; or
- Necessary to provide for intensive visitor use in developed areas, and both of the following conditions exist:
  - Available native species will not meet park management objectives; and
  - The exotic species is managed so it will not spread or become a pest on park or adjacent lands; or
- A sterile, non-invasive plant that is used temporarily for erosion control; or
- Directed by law or expressed legislative intent.

Domestic livestock such as cattle, sheep, goats, horses, mules, burros, reindeer, and llamas are exotic species that are maintained in some parks for purposes of commercial herding, pasturing, grazing, or trailing; for recreational use; or for administrative use for maintaining the historic scene or supporting park operations. The policies applicable to the grazing of commercial domestic livestock are discussed in chapter 8, section 8.6.8. The Service will phase out the commercial grazing of livestock whenever possible, and will manage recreational and administrative uses of livestock to prevent those uses from unacceptably impacting park natural resources.

4.4.4.2 Removal of Exotic Species Already Present

All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species:

- Interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or
- Disrupts the genetic integrity of native species; or
- Disrupts the accurate presentation of a cultural landscape; or
- Damages cultural resources; or
- Significantly hampers the management of park or adjacent lands; or
- Poses a public health hazard as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or
- Creates a hazard to public safety.

High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controllable. Lower priority will be given to exotic species that have almost no impact on park resources or that probably cannot be successfully controlled.

The decision to initiate management should be based on a determination that the species is exotic. For species determined to be exotic and where management appears to be feasible and effective, superintendents should (1) evaluate the species' current or potential impact on park resources; (2) develop and implement exotic species management plans according to established planning procedures; (3) consult, as appropriate, with federal and state agencies; and (4) invite public review and comment, where appropriate. Programs to manage exotic species will be designed to avoid causing significant damage to native species, natural ecological communities, natural ecological processes, cultural resources, and human health and safety.

(Also see Executive Order # 13112 (Invasive Species))

4.4.5 Pest Management

All park employees, concessioners, contractors, permittees, licensees, and visitors on all lands managed or regulated by the National Park Service will comply with NPS pest management policies.

4.4.5.1 Pests

Pests are living organisms that interfere with the purposes or management objectives of a specific site within a park, or that jeopardize human health or safety. Decisions concerning whether or not to manage a pest or pest population will be influenced by whether the pest is an exotic or a native species. Exotic pests will be managed according to the exotic species policies in section 4.4.4. Native pests will be allowed to function unimpeded, except as noted below. Many fungi, insects, rodents, disease organisms, and other organisms that may be perceived as pests are, in fact, native organisms existing under

natural conditions and are natural elements of the ecosystem. Also, native pests that were evident in pesticide-free times are traditional elements in park cultural settings:

The Service may control native pests to:

- Conserve threatened, rare, or endangered species, or unique specimens or communities;
- Preserve, maintain, or restore the historical integrity of cultural resources;
- Conserve and protect plants, animals, and facilities in developed areas;
- Prevent outbreaks of a pest from invading uninfested areas outside the park; or
- Manage a human health hazard when advised to do so by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program), or to otherwise protect against a significant threat to human safety.

4.4.5.2 Integrated Pest Management Program

The Service conducts an integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies. IPM is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, by cost-effective means, while posing the least possible risk to people, resources, and the environment.

The Service, and each park unit, will use an IPM approach to address pest issues. Proposed pest management activities must be conducted according to the IPM process prescribed in Director's Order #77-7: Integrated Pest Management. Pest issues will be reviewed on a case-by-case basis. Controversial issues, or those that have potential to negatively impact the environment, must be addressed through established planning procedures and be included in an approved park management or IPM plan. IPM procedures will be used to determine when to implement pest management actions, and which combination of strategies will be most effective for each pest situation.

Under the Service's IPM program, all pesticide use on lands managed or regulated by the Service, whether that use was authorized or unauthorized, must be reported annually.

4.4.5.3 Pesticide Use

A pesticide, as defined by the Federal Insecticide, Fungicide and Rodenticide Act, is any substance or mixture that is used in any manner to destroy, repel, or control the growth of any viral, microbial, plant, or animal pest. Except as identified in the next paragraph, all prospective users of pesticides in parks must submit pesticide use requests, which will be reviewed on a case-by-case basis, taking into account environmental effects, cost and staffing, and other relevant considerations. The decision to incorporate a chemical, biological, or bio-engineered pesticide into a management strategy will be based on a determination by a designated IPM specialist that it is necessary, and that all other available options are either not acceptable or not feasible.

Insect repellents, bear deterrent sprays, and insecticides applied to persons or to livestock must conform to NPS policies and approval procedures, except that pesticides used under the following conditions do not require approval:

- Cleansers and disinfectants used in restrooms and restaurants;
- Personal insect repellents, insecticides, and bear deterrent sprays that employees or park visitors personally obtain and use to meet personal needs; or
- Insect repellents and insecticides applied to personally owned pets and pack and saddle stock.

4.4.5.4 Biological Control Agents and Bio-engineered Products

The application or release of any bio-control agent or bio-engineered product relating to pest management activities must be reviewed by designated IPM specialists in accordance with Director's Order #77-7, and conform to the exotic species policies in section 4.4.4.

4.4.5.5 Pesticide Purchase and Storage

Pesticides must not be stockpiled. No pesticides may be purchased unless they are authorized and expected to be used within one year from the date of purchase. Pesticide storage, transport, and disposal will comply with procedures established by (1) the Environmental Protection Agency; (2) the individual states in which parks are located; and (3) Director's Order #30A: Hazardous and Solid Waste Management, Director's Order #77-1: Wetland Protection, and Director's Order 77-7.

(See Planning for Natural Resource Management 4.1.1; Genetic Resource Management Principles 4.4.1.2; Management of Exotic Species 4.4.4)

4.5 Fire Management

Naturally ignited fire is a process that is part of many of the natural systems that are being sustained in parks. Human-ignited fires often cause the unnatural destruction of park natural resources. Wildland fire may contribute to or hinder the achievement of park management objectives. Therefore, park fire management programs will be designed to meet park resource management objectives while ensuring that firefighter and public safety are not compromised.

Each park with vegetation capable of burning will prepare a fire management plan and will address the need for adequate funding and staffing to support its fire management program. The plan will be designed to guide a program that responds to the park's natural and cultural resource objectives; provides for safety considerations for park visitors, employees, neighbors, and developed facilities; and addresses potential impacts to public and private property adjacent to the park. An environmental assessment developed in support of the plan will consider the effects on air quality, water quality, health and safety, and natural and cultural resource management objectives. Preparation of the plan and environmental assessment will include collaboration with adjacent communities, interest groups, state and federal agencies, and tribal governments.

All fires burning in natural or landscaped vegetation in parks will be classified as either wildland fires or prescribed fires. All wildland fires will be effectively managed through application of the appropriate strategic and tactical management options. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, and costs. Prescribed fires are those fires ignited

by park managers to achieve resource management and fuel treatment objectives. Prescribed fire activities will include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met. All parks will use a systematic decision-making process to determine the most appropriate management strategies for all unplanned ignitions, and for any prescribed fires that are no longer meeting resource management objectives.

Parks lacking an approved fire management plan may not use resource benefits as a primary consideration influencing the selection of a suppression strategy, but they must consider the resource impacts of suppression alternatives in their decisions. Until a plan is approved, parks must immediately suppress all wildland fires, taking into consideration park resources and values to be protected, firefighter and public safety, and costs. Parks will use methods to suppress wildland fires that minimize impacts of the suppression action and the fire, and are commensurate with effective control, firefighter and public safety, and resource values to be protected.

Suppression activities conducted within wilderness, including the categories of designated, recommended, potential, proposed, and study areas, will be consistent with the "minimum requirement" concept identified in Director's Order #41: Wilderness Preservation and Management.

(See General Management Concepts 4.1; Partnerships 4.1.4; Restoration of Natural Systems 4.1.5; Air Resource Management 4.7; Fire Detection, Suppression, and Post-fire Rehabilitation and Protection 5.3.1.2; Fire Management 6.3.9; Visitor Safety 8.2.5.1; Structural Fire Protection and Suppression 9.1.8. Also see Director's Order #18: Wildland Fire Management)

4.6 Water Resource Management

4.6.1 Protection of Surface Waters and Groundwaters

The Service will perpetuate surface waters and groundwaters as integral components of park aquatic and terrestrial ecosystems.

4.6.2 Water Rights

Water for the preservation and management of the national park system will be obtained and used in accordance with legal authorities. The Park Service will consider all available authorities on a case-by-case basis and will pursue those that are the most appropriate to protect water-related resources in parks. While preserving its legal remedies, the Service will work with state water administrators to protect park resources, and will participate in negotiations to seek the resolution of conflicts among multiple water claimants. Water essential for NPS needs will be purchased if it is not otherwise available. NPS consumptive use of water will be efficient and frugal, especially in water-scarce areas.

All rights to the use of water diverted from or used on federal lands within the national park system by the United States or its concessioners, lessors, or permittees will be perfected in the name of the United States.

Park waters—either surface waters or groundwater—will be withdrawn for consumptive use only when such withdrawal is absolutely necessary for the use and management of the park. All park water withdrawn for domestic or administrative uses will be returned to the park watershed system once it has been treated to a degree that ensures that there will be no impairment of park resources.

The Service may enter into contracts providing for the sale or lease of water to persons, states, or their political subdivisions that provide public accommodations or services for park visitors outside the park, but within the immediate vicinity of a park, and that have no reasonable alternative sources of water. The Service will authorize such contracts only if the water transfer does not jeopardize or unduly interfere with the natural or cultural resources of the park, and the government's costs are fully recovered. The Service will generally authorize only short-term, truly emergency, sales or leases of water. The Service will follow the requirements and procedures of Director's Orders #35A and #35B when considering the sale or lease of park water.

(See Decision-making Requirements to Avoid Impairments 1.4.7; External Threats to Park Resources and Values 1.5)

4.6.3 Water Quality

The pollution of surface waters and groundwaters by both point and non-point sources can impair the natural functioning of aquatic and terrestrial ecosystems, and diminish the utility of park waters for visitor use and enjoyment. The Service will determine the quality of park surface and groundwater resources and avoid, whenever possible, the pollution of park waters by human activities occurring within and outside of parks. The Service will:

- Work with appropriate governmental bodies to obtain the highest possible standards available under the Clean Water Act for the protection for park waters;
- Take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations; and
- Enter into agreements with other agencies and governing bodies, as appropriate, to secure their cooperation in maintaining or restoring the quality of park water resources.

(See Pest Management 4.4.5; Soil Resource Management 4.8.2.4; Backcountry Use 8.2.2.4; Mineral Exploration and Development 8.7; Grazing by Domestic and Feral Livestock 8.6.8; Water Supply Systems 9.1.5.1; Wastewater Treatment Systems 9.1.5.2; Waste Management and Contaminant Issues 9.1.6; Facilities for Water Recreation 9.3.4.2. Also see Director's Order #83: Public Health Programs)

4.6.4 Floodplains

In managing floodplains on park lands, the National Park Service will (1) manage for the preservation of floodplain values; (2) minimize potentially hazardous conditions associated with flooding; and (3) comply with the NPS Organic Act and all other federal laws and Executive orders related to the management of activities in flood-prone areas, including Executive Order 11988 (Floodplain Management), NEPA, applicable provisions of the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899. Specifically, the Service will:

- Protect, preserve, and restore the natural resources and functions of floodplains;
- Avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains; and
- Avoid direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks.

When it is not practicable to locate or relocate development or inappropriate human activities to a site outside and not affecting the floodplain, the Service will:

- Prepare and approve a statement of findings, in accordance with procedures described in Director's Order 77-2: Floodplain Management; and
- Use non-structural measures as much as practicable to reduce hazards to human life and property, while minimizing the impact to the natural resources of floodplains; and
- Ensure that structures and facilities are designed to be consistent with the intent of the standards and criteria of the National Flood Insurance Program (44 CFR Part 60).

(See Siting Facilities to Avoid Natural Hazards 9.1.1.6)

4.6.5 Wetlands

The Service will manage wetlands in compliance with NPS mandates and the requirements of Executive Order 11990 (Wetland Protection), the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899, and the procedures described in Director's Order 77-1: Wetland Protection. The Service will (1) provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; (2) preserve and enhance the natural and beneficial values of wetlands; and (3) avoid direct and indirect support of new construction in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands.

The Service will implement a "no net loss of wetlands" policy. In addition, the Service will strive to achieve a longer term goal of net gain of wetlands across the national park system through restoration of previously degraded or destroyed wetlands.

When natural wetland characteristics or functions have been degraded or lost due to previous or on-going human actions, the Service will, to the extent practicable, restore them to pre-disturbance conditions.

The Service will conduct or obtain parkwide wetland inventories to help ensure proper planning with respect to the management and protection of wetland resources. Additional, more detailed wetland inventories will be conducted in areas that are proposed for development or are otherwise susceptible to degradation or loss due to human activities.

When practicable, the Service will not simply protect, but will seek to enhance, natural wetland values by using them for educational, recreational, scientific, and similar purposes that do not disrupt natural wetland functions.

For proposed new development or other new activities, plans, or programs that are either located in, or otherwise have the potential for direct or indirect adverse impacts on, wetlands, the Service will employ the following sequence:

- Avoid adverse wetland impacts to the extent practicable;
- Minimize impacts that cannot be avoided; and
- Compensate for remaining unavoidable adverse wetland impacts by restoring wetlands that have been previously destroyed or degraded.

Compensation for wetland impacts or losses will require that at least one acre of wetlands be restored for each acre destroyed or degraded.

Actions proposed by the NPS that have the potential to cause adverse impacts on wetlands must be addressed in an environmental assessment or an environmental impact statement. If the preferred alternative will result in adverse impacts on wetlands, a statement of findings must be prepared and approved in accordance with Director's Order #77-1.

(See Decision-making Requirements to Avoid Impairments 1.4.7; Siting Facilities to Avoid Natural Hazards 9.1.1.6)

4.6.6 Watershed and Stream Processes

The Service will manage watersheds as complete hydrologic systems, and will minimize human disturbance to the natural upland processes that deliver water, sediment, and woody debris to streams. These processes include runoff, erosion, and disturbance to vegetation and soil caused by fire, insects, meteorologic events, and mass movements. The Service will manage streams to protect stream processes that create habitat features such as floodplains, riparian systems, woody debris accumulations, terraces, gravel bars, riffles, and pools. Stream processes include flooding, stream migration, and associated erosion and deposition.

The Service will achieve the protection of watershed and stream features primarily by avoiding impacts to watershed and riparian vegetation, and by allowing natural fluvial processes to proceed unimpeded. When conflicts between infrastructure (such as bridges and pipeline crossings) and stream processes are unavoidable, NPS managers will first consider relocating or redesigning facilities, rather than manipulating streams. Where stream manipulation is unavoidable, managers will use techniques that are visually non-obtrusive and that protect natural processes to the greatest extent practicable.

(See Floodplains 4.6.4; Shorelines and Barrier Islands; 4.8.1.1; Facility Planning and Design 9.1.1. Also see "Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management," 65 FR 62566, October 18, 2000)

4.7 Air Resource Management

4.7.1 Air Quality

The National Park Service has a responsibility to protect air quality under both the 1916 Organic Act and the Clean Air Act (CAA). Accordingly, the Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas. Vegetation, visibility, water quality, wildlife, historic and pre-

historic structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are referred to as "air quality-related values." The Service will assume an aggressive role in promoting and pursuing measures to protect these values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the Service will err on the side of protecting air quality and related values for future generations.

Superintendents will take actions consistent with their affirmative responsibilities under the CAA to protect air quality-related values in Class I areas. Class I areas are national parks over 6,000 acres and national wilderness areas over 5,000 acres that were in existence on August 7, 1977. The CAA establishes a national goal of preventing any future, and remedying any existing, human-made visibility impairment in Class I areas. The Service supports that goal, and will take advantage of opportunities created by the CAA to help achieve it.

The CAA also recognizes the importance of integral vistas, which are those views perceived from within Class I areas of a specific landmark or panorama located outside the boundary of the Class I area. Integral vistas have been identified by the Service and are listed in Natural Resources Reference Manual 77. There are no regulations requiring special protection of these integral vistas, but the Service will strive to protect these park-related resources through cooperative means.

Although the CAA gives the highest level of air quality protection to Class I areas, it provides many opportunities for the Service to participate in the development of pollution control programs to preserve, protect, and enhance the air quality of all units of the National Park System. Regardless of Class I designation, the Service will take advantage of these opportunities.

Air resource management requirements will be integrated into NPS operations and planning, and all air pollution sources within parks – including prescribed fire management and visitor use activities – will comply with all federal, state, and local air quality regulations and permitting requirements. Superintendents will make reasonable efforts to notify visitors and employees when air pollution concentrations within an area exceed the national or state air quality standards established to protect public health. Furthermore, because the current and future quality of park air resources depends heavily on the actions of others, the Service will acquire the information needed to effectively participate in decision-making that affects park air quality. The Service will:

- Inventory the air quality-related values associated with each park;
- Monitor and document the condition of air quality and related values;
- Evaluate air pollution impacts, and identify causes;
- Minimize air quality pollution emissions associated with park operations, including the use of prescribed fire and visitor use activities; and
- Ensure healthful indoor air quality in NPS facilities.

External programs needed to remedy existing, and prevent future, impacts on park resources and values from human-caused air pollution will be aggressively pursued by Service participation in the development of federal, state, and local air pollution control plans and regulations. Permit applications for major new air pollution sources will be reviewed, and potential impacts will be assessed. If it is determined that any such new source might cause or contribute to an adverse impact on air quality-related values, the NPS will recommend to the permitting authority that the construction permit be denied or modified to eliminate adverse impacts.

The public's understanding of park air quality issues will be promoted through educational and interpretive programs.

(See External Threats and Opportunities 1.5; Fire Management 4.5; Environmental Monitoring and Control 5.3.1.4; Resource Issue Interpretation and Education 7.5.3; Visitor Safety and Emergency Response 8.2.5; Energy Management 9.1.7)

4.7.2 Weather and Climate

Parks containing significant natural resources will gather and maintain baseline climatological data for perpetual reference.

Because any human attempt to modify weather has the potential to alter the natural conditions in parks, the Service will not conduct weather-modification activities, and will seek to prevent weather-modification activities conducted by others from affecting park weather, climate, and resources.

(See NPS-conducted or NPS-sponsored Inventory, Monitoring, and Research Studies 4.2.1; Miscellaneous Management Facilities 9.4.5)

4.8 Geologic Resource Management

The Park Service will preserve and protect geologic resources as integral components of park natural systems. As used here, the term "geologic resources" includes both geologic features and geologic proccesses. The Service will (1) assess the impacts of natural processes and human-related events on geologic resources; (2) maintain and restore the integrity of existing geologic resources; (3) integrate geologic resource management into Service operations and planning; and (4) interpret geologic resources for park visitors.

4.8.1 Protection of Geologic Processes

The Service will allow natural geologic processes to proceed unimpeded. Geologic processes are the natural physical and chemical forces that act within natural systems, as well as upon human developments, across a broad spectrum of space and time. Such processes include, but are not limited to, exfoliation, erosion and sedimentation, glaciation, karst processes, shoreline processes, and seismic and volcanic activity. Geologic processes will be addressed during planning and other management activities in an effort to reduce hazards that can threaten the safety of park visitors and staff and the long-term viability of the park infrastructure.

Intervention in natural geologic processes will be permitted only when:

- Directed by Congress;
- Necessary in emergencies that threaten human life and property;
- There is no other feasible way to protect natural resources, park facilities, or historic properties; or

- Intervention is necessary to restore impacted conditions and processes, such as restoring habitat for threatened or endangered species.

4.8.1.1 Shorelines and Barrier Islands

Natural shoreline processes (such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration) will be allowed to continue without interference.

Where human activities or structures have altered the nature or rate of natural shoreline processes, the Service will, in consultation with appropriate state and federal agencies, investigate alternatives for mitigating the effects of such activities or structures and for restoring natural conditions. The Service will comply with the provisions of Executive Order 11988 (Floodplain Management) and state coastal zone management plans prepared under the Coastal Zone Management Act of 1972.

Any shoreline manipulation measures proposed to protect cultural resources may be approved only after an analysis of the degree to which such measures would impact natural resources and processes, so that an informed decision can be made through an assessment of alternatives.

Where erosion control is required by law, or where present developments must be protected in the short run to achieve park management objectives, including high-density visitor use, the Service will use the most effective and natural-appearing method feasible, while minimizing impacts outside the target area.

New developments will not be placed in areas subject to wave erosion or active shoreline processes unless (1) the development is required by law; or (2) the development is essential to meet the park's purposes, as defined by its establishing act or proclamation, and

- No practicable alternative locations are available,
- The development will be reasonably assured of surviving during its planned life span, without the need for shoreline control measures, and
- Steps will be taken to minimize safety hazards and harm to property and natural resources.

(See Floodplains 4.6.4; Cultural Resources Chapter 5; Siting Facilities to Avoid Natural Hazards 9.1.1.6. Also see Director's Order #77-2: Floodplain Management)

4.8.1.2 Karst

The Service will manage karst terrain to maintain the inherent integrity of its water quality, spring flow, drainage patterns, and caves. Karst processes (the processes by which water dissolves soluble rock such as limestone) create areas typified by sinkholes, underground streams, caves, and springs.

Local and regional hydrological systems resulting from karst processes can be directly influenced by surface land use practices. If existing or proposed developments do or will significantly alter or adversely impact karst processes, these impacts will be mitigated. Where practicable, these developments will be placed where they will not have an effect on the karst system.

4.8.1.3 Geologic Hazards

Naturally-occurring geologic processes, which the NPS is charged to preserve unimpaired, can be hazardous to humans and park infrastructure. These include earthquakes, volcanic eruptions, mudflows, landslides, floods, shoreline processes, tsunamis, and avalanches. The Service will work closely with specialists at the U.S. Geological Survey and elsewhere, and with local, state, and federal disaster management officials, to devise effective geologic hazard identification and management strategies. Although the magnitude and timing of future geologic hazards are difficult to forecast, park managers will strive to understand future hazards and, once the hazards are understood, minimize their potential impact on visitors, staff, and developed areas. Before interfering with natural processes that are potentially hazardous, superintendents will consider alternatives such as closing an area to visitors or relocating facilities.

The Service will try to avoid placing new visitor and other facilities in geologically hazardous areas. Superintendents will examine the feasibility of phasing out, relocating, or providing alternative facilities for park developments subject to hazardous processes, consistent with other sections of these management policies.

(See Siting Facilities to Avoid Natural Hazards 9.1.1.6)

4.8.2 Management of Geologic Features

The Service will protect geologic features from the adverse effects of human activity, while allowing natural processes to continue. The term "geologic features" describes the products and physical components of geologic processes. Examples of geologic features in parks include rocks, soils, and minerals; geysers and hot springs in geothermal systems; cave and karst systems; canyons and arches in erosional landscapes; sand dunes, moraines, and terraces in depositional landscapes; dramatic or unusual rock outcrops and formations; and paleontological and paleoecological resources such as fossilized plants or animals, or their traces.

4.8.2.1 Paleontological Resources and Their Contexts

Paleontological resources, including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research. The Service will study and manage paleontological resources in their paleoecological context (that is, in terms of the geologic data associated with a particular fossil that provides information about the ancient environment).

Superintendents will establish programs to inventory paleontological resources and systematically monitor for newly exposed fossils, especially in areas of rapid erosion. Scientifically significant resources will be protected by collection or by on-site protection and stabilization. The Service will encourage and help the academic community to conduct paleontological field research in accordance with the terms of a scientific research and collecting permit. Fossil localities and associated geologic data will be adequately documented when specimens are collected. Paleontological resources found in an archeological context are also subject to the policies for archeological resources. Paleontological specimens that are to be retained permanently are subject to the policies for museum objects.

The Service will take appropriate action to prevent damage to, and unauthorized collection of, fossils. To protect paleonto-

logical resources from harm, theft, or destruction, the Service will ensure, where necessary, that information about the nature and specific location of these resources remains confidential, in accordance with the National Parks Omnibus Management Act of 1998.

Parks will exchange fossil specimens only with other museums and public institutions dedicated to the preservation and interpretation of natural heritage and qualified to manage museum collections. Fossils to be deaccessioned in an exchange must fall outside of the park's scope of collection statement. Exchanges must follow deaccession procedures in the Museum Handbook, Part II, chapter 6.

The sale of original paleontological specimens is prohibited in parks.

The Service generally will avoid purchasing fossil specimens. Casts or replicas should be acquired instead. A park may purchase fossil specimens for the park museum collection only after making a written determination that:

- The specimens are scientifically significant, and are accompanied by detailed locality data and pertinent contextual data;
- The specimens were legally removed from their site of origin, and all transfers of ownership have been legal;
- The preparation of the specimens meets professional standards;
- The alternatives for making these specimens available to science and the public are unlikely; and
- Acquisition is consistent with the park's enabling legislation and Scope of Collection Statement, and will ensure the specimens' availability in perpetuity for public education and scientific research.

All National Park Service construction projects in areas with potential paleontological resources must be preceded by a preconstruction surface assessment prior to disturbance. For any occurrences noted, or when the site may yield paleontological resources, the site will be avoided, or the resources will, if necessary, be collected and properly cared for prior to the initiation of the construction disturbance. Areas with potential paleontological resources must also be monitored during construction projects.

(See Natural Resource Information 4.1.2; Studies and Collections 4.2; Independent Research 5.1.2; Artifacts and Specimens 10.2.4.5. Also see 36 CFR 2.5)

4.8.2.2 Caves

As used here, the term "caves" includes karst (such as limestone and gypsum caves) and non-karst caves (such as lava tubes, littoral caves, and talus caves). The Service will manage caves in accordance with approved cave management plans to perpetuate the natural systems associated with the caves, such as karst and other drainage patterns, air flows, mineral deposition, and plant and animal communities. Wilderness and cultural resources and values will also be protected.

No developments or uses, including those that allow for general public entry, such as pathways, lighting, and elevator shafts, will be allowed in, above, or adjacent to caves until it can be demonstrated that they will not unacceptably impact natural cave conditions, including sub-surface water movements. Developments already in place above caves will be removed if they are impairing or threatening to impair natural conditions or resources.

Parks will strive to close caves or portions of caves to public use, or to control such use, when such actions are required for the protection of cave resources or for human safety. Some caves or portions of caves may be managed exclusively for research, with access limited to permitted research personnel. All recreational use of undeveloped caves will be governed by a permit system. "Significant" caves will be identified using the criteria established in the 43 CFR Part 37 regulations for the Federal Cave Resources Protection Act of 1988 (FCRPA). As further established by the FCRPA, specific locations of significant cave entrances may be kept confidential and exempted from FOIA requests.

(See Decision-making Requirements to Avoid Impairments 1.4.7; Information Confidentiality 1.7.3; Caves 6.3.11.2)

4.8.2.3 Geothermal and Hydrothermal Resources

Thermal resources within units of the national park system will be protected, preserved, and managed as a critical component of the units' natural resource systems, and for public education, interpretation, and scientific research. Thermal resources, also known as geothermal or hydrothermal systems, are comprised of a subsurface heat source, heat conduit rock formations, and air and/or water that circulates through the formations and may discharge at the surface, creating features such as geysers, hot springs, mudpots, fumaroles, unique/rare mineral precipitates and formations, and hydrophilic biotic communities.

Superintendents will strive to maintain the natural integrity of thermal systems, including the movement of air and/or water through the heated rock, cold water recharge, the proximity of the hot and warm water to the heat source, and the hydrostatic pressure and elevated temperature.

Superintendents will work to prevent impacts caused by the development of thermal resources. Such impacts include the loss of surface thermal features; land subsidence; an increase in seismic activity; the release of noxious gases; noise and surface disturbance from drilling or power plant construction; and the release of polluted water or brines. Because thermal systems may extend well beyond park boundaries, the NPS will work closely with federal, state, and tribal agencies to delineate the full extent of thermal resources, and protect those that occur within parks. In protecting park thermal resources, superintendents should consider authorities available under the Geothermal Steam Act of 1970, as amended; state water rights; and mineral leasing laws.

As required by the Geothermal Steam Act, the NPS will maintain a list of significant thermal features within park units. The criteria and procedures for designating significant thermal resources within parks are specified within the Geothermal Steam Act Amendments of 1988. In cooperation with the U.S. Geological Survey, the NPS will conduct a monitoring program for the designated significant thermal features.

4.8.2.4 Soil Resource Management

The Service will actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible,

the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources. Parks will obtain surveys of soils adequate for the management of park resources. All soil surveys will follow National Cooperative Soil Survey Standards. Products will include soil maps, determinations of the physical and chemical characteristics of soils, and the interpretations needed to guide resource management and development decisions.

Management action will be taken by superintendents to prevent—or if that is not possible, to minimize—adverse, potentially irreversible impacts on soils. Soil conservation and soil amendment practices may be implemented to reduce impacts. Importation of off-site soil or soil amendments may be used to restore damaged sites. Off-site soil normally will be salvaged soil, not soil removed from pristine sites, unless the use of pristine site soil can be achieved without causing any overall ecosystem impairment. Prior to using any off-site materials, parks must develop a prescription, and select the materials that will be needed to restore the physical, chemical, and biological characteristics of original native soils without introducing any exotic species.

When soil excavation is an unavoidable part of an approved facility development project, the Service will minimize soil excavation, erosion, and off-site soil migration during and after the development activity.

When use of a soil fertilizer or other soil amendment is an unavoidable part of restoring a natural landscape or maintaining an altered plant community, the use will be guided by a written prescription. The prescription will be designed to ensure that such use of soil fertilizer or soil amendment does not unacceptably alter the physical, chemical, or biological characteristics of the soil, biological community, or surface or ground waters.

(See Evaluating Environmental Impacts 4.1.3; Natural Re source Collections 4.2.3; Floodplains 4.6.4; Wetlands 4.6.5; Facility Planning and Design 9.1.1)

4.9 Soundscape Management

The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks. Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials.

Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Examples of such natural sounds include:

- Sounds produced by birds, frogs, or katydids to define territories or aid in attracting mates;
- Sounds produced by bats or porpoises to locate prey or navigate;
- Sounds received by mice or deer to detect and avoid predators or other danger; and
- Sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water.

The Service will restore degraded soundscapes to the natural condition wherever possible, and will protect natural soundscapes from degradation due to noise (undesirable human-caused sound).

Using appropriate management planning, superintendents will identify what levels of human-caused sound can be accepted within the management purposes of parks. The frequencies, magnitudes, and durations of human-caused sound considered acceptable will vary throughout the park, being generally greater in developed areas and generally lesser in undeveloped areas. In and adjacent to parks, the Service will monitor human activities that generate noise that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The Service will take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored.

(See Use of Motorized Equipment 8.2.3; Overflights and Aviation Uses 8.4)

4.10 Lightscape Management

The Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light. The absence of light in caves and at the bottom of deep bodies of water influences biological processes and the evolution of species, such as the blind cave cricket. The phosphorescence of waves on dark nights helps hatchling sea turtles orient to the ocean. The stars, planets, and earth's moon that are visible during clear nights influence humans and many other species of animals, such as birds that navigate by the stars or prey animals that reduce their activities during moonlit nights.

Recognizing the roles that light and dark periods and darkness play in natural resource processes and the evolution of species, the Service will protect natural darkness and other components of the natural lightscape in parks. To prevent the loss of dark conditions and of natural night skies, the Service will seek the cooperation of park visitors, neighbors, and local government agencies to prevent or minimize the intrusion of artificial light into the night scene of the ecosystems of parks. The Service will not use artificial lighting in areas such as sea turtle nesting locations, where the presence of the artificial lighting will disrupt dark-dependent natural resource components of a park.

The Service will:

- Restrict the use of artificial lighting in parks to those areas where security, basic human safety, and specific cultural resource requirements must be met;
- Utilize minimal impact lighting techniques; and
- Shield the use of artificial lighting where necessary to prevent the disruption of the night sky, natural cave processes, physiological processes of living organisms, and similar natural processes.

The decision about whether or not to install artificial lighting in particular circumstances is left to the discretion of the superintendent, and is made through the planning process.

(See Visitor Safety and Emergency Response 8.2.5, Facility Planning and Design 9.1.1; Integration of Facilities into the Park Environment 9.1.1.2; Energy Management 9.1.7)

4.11 Chemical Information and Odors

The Service will preserve, to the greatest extent possible, the natural flow of natural chemical information and odors, by preventing (1) the release of human-generated chemicals that can block the release, deposition, or perception of natural chemicals; and (2) human actions that disrupt or commingle the pathways through which natural chemicals are dispersed.

Such information and odors are naturally produced and chemically based, and transmit information that is received by living organisms. Natural chemicals involved in the transmission of information are released by animals, plants, and geologic materials. Once released, these chemicals can be transmitted through air and water. Many animals can perceive these natural chemicals and modify their behaviors, such as mating, migration, feeding, predator avoidance, prey selection, and the establishment of social structures, as a response. Specific examples of relationships that involve natural chemical information and odors include, among others:

- Scent posts where one animal deposits one or more chemicals by rubbing, urination, defecation, or other means, and where other animals can detect the passage of the first animal because of the odor produced by a deposited chemical;
- Flowers that produce odors that attract insects, birds, and other animals, with resulting cross-pollination of the flowers and reproduction of the species as the outcome;
- Female insects that release chemicals (pheromones) that attract males, with fertilization of the female's eggs and reproduction of the species as the outcome;
- Stressed trees that emit chemicals that some types of beetles use to find weakened trees, which they then successfully can colonize and use as habitat for reproducing themselves; and
- Geologic materials (soils or bedrock) that emit characteristic chemicals that fish can sense and use as guides to find the places in streams where they hatched and where they subsequently return to breed and deposit fertilized eggs, with reproduction of the species as the outcome.

The Service acknowledges that some of its management activities may necessarily alter the natural flow of natural chemical information and odors. The Service may, for example:

- Introduce pesticides or pheromones into parks as part of an integrated pest management program;
- Construct and operate intensive development areas that eliminate animal scent stations and introduce unnatural chemicals;
- Change the vegetation and thereby change the kinds of natural plant chemicals released to the air;
- Move water from one drainage to another through water and sewer systems; or
- Provide for the use of exhaust-emitting motors in the air, on land, and on water.

Whenever the Service engages in activities that disrupt the natural flow of natural chemical information or odors, it will comply with all applicable laws, regulations, and policies, and seek to minimize harm to the environment. In no case will the Service engage in an activity if it will impair park resources or values.